# AI Mk 17 Radar System in Sea Venom FAW Mk 53 RAN Aircraft - Trials and Tribulations -

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## Background

The AI Mk 17 Radar was developed as an airborne Radar aircraft installation for fighter aircraft to provide aircrew with target acquisition information under adverse flying conditions, such as cloud, rain or night flying when it was not possible to obtain visual contact with targets, i.e. it was a “blind firing” radar!. The principal targets considered were enemy aircraft.

A succession of Air Intercept Radars had been produced in the United Kingdom for use in RAF & RN fighter aircraft, each new development having better performance & more operating features than the previous version. In the early 1950s, AI Mk 17 Radar was in its design/development phase & this was the Air Intercept Radar chosen by the Royal Australian Navy to be fitted in its new jet fighter aircraft – the Sea Venom FAW Mk 53 for operation from the soon to be acquired angled deck aircraft carrier, HMAS Melbourne, then being built at Barrow-in-Furness, Lancashire, England.

## Design Authority

The Design Authority for the AI Mk17 Radar equipment was the Royal Radar Establishment located at Malvern, Worcestershire, England.

## Users

Whilst the AI Mk 17 Radar was under development, there emerged two main user groups for the equipment – they were the Royal Air Force & the Royal Australian Navy. The Royal Air Force intended the Radar to be fitted to the first 300 of the Gloster Javelin All Weather Interceptor Fighter Aircraft whilst the Royal Australian Navy were to purchase the AI Mk 17 Radar for all of its 39 Sea Venom FAW Mk 53 Aircraft. Other AI Mk 17 Radars were purchased for operational spares. History ultimately showed that the Royal Air Force only fitted the AI Mk 17 Radar to the first 40 of a total of 436 Gloster Javelin Fighter Aircraft produced, with production having commenced in 1954. Those 40 aircraft were designated as type F(AW) Mk 1

On 23 July, 1951, the Australian Minister for the Navy, Mr William Mahon announced the de Havilland Sea Venom would be ordered for the RAN & the order was subsequently made formal in December, 1951.

The Sea Venom FAW Mk 53 was to be capable of operating in all weather conditions, day or night & so needed Radar equipment to meet this requirement. The design of the RAN's Venom FAW Mk 53s was basically similar to the Royal Navy's Venom FAW Mk 21 with the exception of the Radar equipment. The Royal Navy opted for an American Radar – the AN APS 52 equipment.
At the de Havilland Aircraft Factory at Christchurch, Hampshire, the Royal Navy Sea Venom FAW Mk 21 & the Royal Australian Navy FAW Mk 53 were produced concurrently.

The first RAN Sea Venom FAW Mk 53 aircraft became available for fitting of the AI Mk 17 Radar & various trials in the third quarter of 1954.

**Initial Technical Training of RAN Personnel in AI Mk 17 Radar**
By authority of J.B. Foley, the then RAN Liaison Officer at Australia House, The Strand, London, in March, 1954 arrangements were completed for Sub-Lt(l) J.G.Sommervelle & Radio Electrician (Air) J.S.Saywell to undertake 13 weeks of technical training at the Royal Radar Establishment at Malvern & those manufacturers producing the various units comprising the total Radar system.

Sub-Lt(L) J.G. Sommervelle & Radio Electrician (Air) J.S.Saywell became integrated into the team introducing the AI Mk 17 Radar equipment into service with the RAF & the RAN. There followed liaison with the various manufacturers to head off potential problems with equipment when in service. Some modifications were introduced, at the manufacturing stage, which improved the reliability of the equipment in service.

**The Manufacture of the AI Mk 17 Radar.**
The AI Mk 17 Radar system was designated as ARI 5807, where ARI = Air Radio Installation. The Radar system was comprised of a number of units of various sizes which had to fit into any available nook or cranny in an already crammed full aircraft. By breaking the installation down into a number of units made it easier to fit the total equipment into the aircraft. Of course, some pieces of equipment by virtue of their functionality had to be located in set locations, e.g. the Radar antenna, the Observer/Navigator's Radar indicator & the Pilot's Radar-Ranging Gyro Gunsight.
A number of manufacturers were involved in producing the various units comprising the AI Mk 17 Radar System:-

- Metropolitan-Vickers Electrical Co. Ltd., Manchester manufactured the Scanning Unit 122; Servo Amplifier A3706 & the Modulator Unit 301.

- E.M.I.E.D. Ltd, Feltham & E.M.I.Factories Ltd, Wembley manufactured the Transmitter Receiver 3701.
- E.K.Cole Ltd, Malmesbury manufactured the Radar Indicator Unit, Type CRT 100 & Control Units Type 900, 901 & 902, Power Unit 901, the Strobe Unit 100 & the Junction Box 389. At the time they were also carrying out development work on a Gating Unit, 10D/18931 & Power Units 910 & 911.
- Heston Aircraft Ltd, Hounslow were responsible for Radome cooling & various connectors & for Ground Running equipment.
- Wayne Kerr Laboratories Ltd, New Malden produced some test equipment, such as the Scanner & Gyro Simulator 40/9 & Test Set X1440.
- Ferguson Radio Ltd, Enfield manufactured the Gating Unit 10D/18931 & Power Units 910 & 911. They were also doing development work on the Power & Cathode Follower Unit X4503 & Cathode Follower Unit X4504 – the latter units were for operating multiple Radar Indicating Units for the training of Navigators.
- G.E.C.Ltd, Union Works, Wembley manufactured the Performance Testing S Band Resonator Type 101.
- S.G. Brown Ltd, Watford manufactured the Gyro Unit Type 2.

**AI Mk17 Radar Brief Technical Details & Operational Aspects**

- **Function**: Primarily intended to be used for Air Intercept & Blind Firing against enemy aircraft targets. Additionally, had a search function throughout its full antenna sweep range in azimuth & elevation, so, providing surface target information. Limited sector scans of the antenna could be initiated in particular zones of interest when zeroing in on a target. When locking on to a target aircraft the system antenna produced a conical beam which was used to produce target “up”, “down” & “left”, “right” information relative to the attacking aircraft flight datum. Target range was derived from the radar & in the final phase of the attack, Radar Range information was fed to the Pilot’s Radar–Ranging Gyro Gunsight to correct the gun aiming for range of the target. At this stage of the attack, additionally, a radar target indication was also fed to the Pilot’s gunsight via a collimator, enabling the Pilot to engage the target under blind firing conditions. The radar was controlled at all times by the Observer/Navigator/Radar Operator located to the right of the Pilot. The Observer/Navigator/Radar Operator had access to all Radar control units & monitored target information on the CRT

Indicating Unit Type 100. The antenna pointing position was able to be controlled via a joystick controller on the main control unit.

- **Radar Band** : S Band
- **Type of Radar** : Pulsed power microwave transmitter; TR & Anti TR Cells; superheterodyne receiver with klystron local oscillator & crystal diode detector
- **Peak Power** : 250 kilowatts peak power
- **Pulse Length** : < 1 microsecond
- **Pulse Repetition Frequency** : Variable, depending on mode of Radar operation
- **Antenna** : Parabolic reflector with a rotatable waveguide fed offset dipole with a reflector element which produced a conical beam (3 degrees angle between half power points) when in the final lock–on mode. In the search modes the rotatable antenna feed was locked in position with the dipole element in a vertical polarisation position. The antenna dish was controlled by servo motors & had gyro correction signals applied for stabilisation purposes. _

**RANSMP at the deHavilland Aircraft Factory.**

A Royal Australian Navy Special Maintenance Party (RANSMP) was established at the de Havilland Aircraft Ltd, Christchurch factory to liaise with the Sea Venom FAW Mk53 aircraft manufacturer to head off any potential problems which could arise under actual service conditions. The RANSMP was comprised of a limited number of personnel from a number of disciplines. The Radar & Electrical aspects were covered by Sub Lt (L) J.G.Sommervelle & Radio Electrician (Air) J.S.Saywell.
There was also a RNSMP present, at the same time, at de Havilland Aircraft Ltd overseeing the Royal Navy Sea Venom FAW Mk 21 aircraft.

At the de Havilland Aircraft factory, John Saywell had a special monitoring panel built to monitor various parameters of the AI Mk 17 Radar fitted in Sea Venom FAW Mk 53, Serial No., WZ893 during its first test flights The monitor panel was strapped to the Observer's legs, above the knees as there was no where else for it to be placed conveniently! This was going to place an obstacle for the Observer in the event of a "bailout" being necessary in flight! John Saywell was to be the Observer, until Australia House, London heard of what was happening & an immediate ban was put on John Saywell flying as the Observer, "As too much had been invested in Saywell to lose him!" Australia House insisted on a de Havilland personnel to occupy the seat. It wasn't necessary for him to bail out in flight & the equipment came through with flying colours

During the period that the RANSMP was at the deHavilland Aircraft factory deck landing trials were carried out using Sea Venom FAW Mk 53, Serial No., WZ893 fitted with AI Mk17 Radar. The deck landing trials were carried out over a couple of days on board HMS Bulwark off the English south coast. Members of the RANSMP were embarked on board HMS Bulwark for those trials, Sub Lt (L). J.G Sommervelle & Chief Radio Electrician (Air) J.S.Saywell covered the Electrical & Radar disciplines during those trials. Commander (L) G.F.E.Knox RAN, who was normally located at Australia House, London was present for the deck landing trials. The AI Mk 17 Radar equipment was physically & functionally checked after each deck landing. There were no problems found during those trials

**Proof Testing of AI Mk 17 Radar at RAF Boscombe Down.**

RAF Boscombe Down was an Experimental Aircraft Establishment run by the RAF & the British Ministry of Supply where new aircraft types were put through their paces prior to being introduced into service. Boscombe Down was north of Salisbury & not far distant from Stonehenge.

The “Cold War”, between the Western & Eastern Blocs was still running strongly & this was a factor in the new types of aircraft to be sighted at RAF, Boscombe Down in those days!

Sea Venom FAW Mk 53, Serial No., WZ893 arrived at Boscombe Down to be put through its paces & to gain a knowledge of the operational performance of the AI Mk 17 Radar in flight. At this stage we were joined by Lt Commander Gavin Kable RAN who was to be the in flight Observer /Navigator/Radar Operator. The Radar performed well except for ground & sea clutter whilst in flight. This was cured by the use of Radar Absorbent Material (RAM) being fitted to the fibre glass radome which formed the nose of the aircraft. There was some experimentation in arriving at the final pattern of the RAM so that it did not detract from the search performance of the Radar.

**“Shooting Trials” using AI Mk17 Radar at 78 Wing RAAF, Takali, Malta G.C.,.**

The next phase of proof testing the performance of the AI Mk17 Radar was to operate an aircraft fitted with the Radar intercepting remote controlled target aircraft, firing its guns & evaluating the in flight performance. Those tests were conducted over a period of some weeks in Malta G.C., commencing in the third quarter of 1954.

Getting to Malta G.C. should have been a relative “breeze”, but it turned out to be a saga in itself! A Royal Air Force Douglas DC3 (a Dakota) “workhorse” aircraft had been allocated for the purpose of

transporting the trials equipment & personnel from RAF Boscombe Down to Takali, Malta G.C. The DC3 had been prior loaded with its extensive content of trials equipment, including spares to support the testbed aircraft. The personnel were located in any available space amongst the freight! It certainly wasn't 1st Class or even Business Class, perhaps it was even below Steerage Class, but, that was the way it was done in those days & no one made any comment about the conditions! Takeoff from Boscombe Down was scheduled for 0600 & this was duly achieved – breakfast was scheduled to be taken at RAF Lyneham from where we would be given clearance to depart for an overseas destination. On takeoff, one wheel came up & the other stayed down & refused to come up. The pilot then tried to drop the wheel which had come up but it refused to go down. The pilot next decided that he would try to shake the wheel that was up to go down; this "shaking" exercise consisted of flying the DC3 as though it were a fighter aircraft with violent moves and steep dives with a vigorous pullout from the dive. Thankfully the pilot kept us informed of what he was doing, but it isn't recommended flying on an empty stomach! The wheel that was "up" stayed where it was throughout all manoeuvres, so finally, the Pilot decided that he had no option except to go in for a crash landing with one wheel up & one wheel down. The next consideration was to use up as much fuel as possible before attempting the landing; this was accomplished after some appreciable time – with a possible breakfast time looking more like lunchtime! With the fuel load being all but depleted it was then into the crash landing phase. On the final approach, the wheel that was up decided to drop down, but lo & behold there was no lock light indicating. Fortunately, the errant wheel was in the lock condition & the landing was completed safely & a late breakfast was enjoyed by those on board. The DC3 was handed over to "maintenance", with another aircraft being organised to take the Trials Team to Lynham where the DC3 was intended to catch up with the Trials Team. With time marching on & no sign of the DC3 another aircraft was arranged to take the Trials Team to Malta with the DC3 to follow with the Trials Equipment. A stopover was scheduled at the French Air Force Experimental Base, located near Istre in the south of France. Late in the day the RAF aircraft had UHF radio failure & as the final leg of the flight to Malta was to be at night across the Mediterranean Sea, the aircrew of our transport aircraft decided to return to England & left us at the French airbase near Istre to await the arrival of the DC3 – it arrived in due course. However, it was to be more than a week before we finally departed from Istre! That DC3 aircraft had more problems than one could wish for & we were beginning to believe that we were forgotten people! Fortunately in the Ville D' Istre there was an annual festival in progress & the Trials Team joined in the celebrations with gusto becoming almost honorary citizens. Parts for

the DC3 were delivered from England & after a successful test flight the Trials Team once more climbed aboard & we headed for Malta. We didn't get far before there was another magneto failure & due to the aircraft loading, height could not be maintained on one engine! It was back to Istre, barely skimming the stone wall at the end of the runway! Then followed more parts flown from England, more test flights & finally another takeoff for Malta, at night. When quite distant from Istre & at height one engine decided it was time to provide some excitement – the "fireworks" appearing from the exhaust were spectacular! But, with one engine malfunctioning we were losing height & various airfields on Mediterranean islands were placed on alert for a potential emergency landing. The faulty engine finally gave up & we continued for Malta losing height. Finally, we arrived over Malta & reached the Takali Airfield with very little height left & when over the runway threshold the remaining engine realised it was time for it to get into the act & promptly failed, causing us to drop like a brick onto the runway! We had arrived – fortunately in one piece!
Note: When the trials were completed the RAF sent a four engined Avro York aircraft to Malta to return the Trials Team to England with the return journey being uneventful! At the time of departure from Malta, the DC3 aircraft was still there, unserviceable!

The location selected for the "shooting" tests was at the Takali airfield, Malta G.C. from which the Royal Australian Air Force 78 Wing was then operating, during a "Middle East Crisis". There was, additionally, a squadron of the Royal Auxiliary Air Force temporarily located at Takali conducting exercises with the Australians. The Australians & their English colleagues were operating in de Havilland Vampire fighter aircraft.

The location in Malta G.C. provided a site with reliable weather & a lot of open space over the Mediterranean Sea in which to conduct the shooting/proof testing trials.
For the trials, the AI Mk17 Radar was installed in a Gloster Meteor NF 11 fighter aircraft & had cameras installed to assess the accuracy of the gun's ammunition, with a liberal mix of tracer shells included, against the target aircraft when being operated with radar information fed to the Radar-Ranging Gyro Gun Sight (GGS). In the initial testing phase the guns were deliberately misaligned, to minimise the cost of target aircraft which were French designed remote radio controlled target aircraft. The Gloster Meteor fighter aircraft Pilot was Polish, having been in the Free Polish Air Force operating in Britain during World War 2 – so, together with a sprinkling of British Ministry Of Supply civilian personnel we had a very International atmosphere about those trials!

The shooting trials proceeded smoothly & successfully with each test being analysed fully & were completed over a period of some weeks culminating in a positive demonstration of shooting down a target aircraft under blind firing conditions. It was then time to return to RAF Boscombe Down, England & wind down the “Shooting” Trials Team.

Further testing of the AI Mk 17 Radar System continued at Boscombe Down in the RAF Gloster Meteor aircraft & the RAN Sea Venom Mk 53 FAW Mk 53, Serial No. WZ893 aircraft.

**AI Mk 17 Radar Training for RAN 808 Squadron Personnel at RNAS Abbotsinch**

The next phase of introducing the AI Mk 17 Radar into the RAN was conducted at the Royal Naval Air Station, Abbotsinch, Scotland (HMS Sanderling). In June, 1955 Chief Radio Electrician (Air) John Saywell proceeded direct from RAF Boscombe Down to RNAS Abbotsinch with a quantity of AI Mk 17 Radar equipment. Other members of the RANSMP who had been at de Havilland aircraft factory, Christchurch, Hampshire had already arrived at RNAS Abbotsinch, awaiting delivery of Sea Venom FAW Mk 53 aircraft & to prepare those aircraft for shipment to Australia on board the new angled flight deck aircraft carrier, HMAS Melbourne.

John Saywell set up the AI Mk 17 Radar System in the RNAS Abbotsinch Radar Workshop in readiness to incorporate late modifications into the equipment & to provide technical training to RAN 808 Squadron Radio personnel who were scheduled to arrive shortly thereafter.

In due course the RAN 808 Squadron personnel were trained in the technicalities of the new AI Mk 17 Radar as well as being trained in the operational functions of the equipment.

The late modifications were successfully completed in all Radar Systems & proved out prior to final installation in each aircraft being prepared for shipment to Australia. Some aircraft had their engines inhibited & those aircraft were cocooned in readiness for long term storage in Australia.

There were a couple of incidents during this stage of work & those were:-

- When a munitions storage facility adjacent to the airfield exploded, killing some civilian staff & causing debris to fall from the Air Radar Workshop ceiling on to the AI Mk 17 Radar equipment & all personnel in the workshop. There was quite

some relief when those present realised that they were uninjured!

- At the time, the Irish Republican Army were very active in their campaign against the British & were then currently raiding Military Establishments & in particular targeting, at night, armouries to acquire arms & munitions. The “Powers Who Be” decided that protective action had to be taken at all Military Establishments. At Abbotsinch, all Chief Petty Officers were detailed to provide that protective action in the form of one man, at a time, during the “Silent Hours”, providing a roving patrol with a particular watch on the armoury – they were ordered to inform no one as to what they were doing & provided with a revolver with three rounds of ammunition – in a pouch, with direct orders that under no circumstances was the revolver to be loaded unless they were being shot at when the revolver could be loaded & shoot to kill. John Saywell was detailed off for those patrols & he advised the RN personnel that if they got him killed they would be in a lot of trouble! Australia House, London & the RAN were completely unaware of this activity. The thought did go through John Saywell’s mind, at the time, that in the event of such a confrontation that there was surely only one likely outcome & the odds of success were not going to be stacked in his favour! Years later, John Saywell asked his immediate superior officer, at the time (Lt (L) J.G. Sommervelle RAN) if he had been aware of those patrols – he had been completely unaware of the patrols!

**AI Mk 17 Radar System Heat Trials in Libya**

After RAN 808 Squadron personnel had been provided with technical training by John Saywell at RNAS Abbotsinch there was still one more trials task to complete for the AI Mk 17 Radar System & the Sea Venom FAW Mk 53 aircraft, Serial No. WZ893 & that was the “Heat Trials”. Arrangements had been completed to conduct those trials in Libya. The RAN personnel allocated for those AI Mk 17 Radar System trials were Lt (L) J.G. Sommervelle, Chief Radio Electrician (Air) T.L. Bail & Leading Radio Electrical Mechanic (Air) G. Kelly.
The location selected for the Heat Trials was at the International Airport at Idris, near Tripoli in Libya where the RAF had a Detachment. The timing was during the Northern Hemisphere Summer of 1955 & flying days were selected to be completed on days when the temperature was 100 Degrees Fahrenheit or more. The AI Mk 17 Radar System performed correctly during the tests. During those trials the Sea Venom aircraft was flown by a Royal Navy Pilot with the Observer/ Navigator/ Radar Operator being Lt Cdr Gavin Kable RAN.

**Setting up the Radar Workshop in HMAS Melbourne**

HMAS Melbourne berthed at King George V Dock, Glasgow & embarked the Sea Venom aircraft & RAN personnel from RNAS Abbotsinch, departing for Australia in March, 1956.

During the trip to Australia, Chief Radio Electrician (Air) John Saywell set up the Air Radar Workshop facilities & provided further technical training for Squadron personnel

A couple of incidents occurred on the run to Australia :-

- The first was when HMAS Melbourne was southbound in the Suez Canal & slowed for an approaching Northbound convoy of ships & there was a very strong cross wind blowing. The Melbourne presented a massive “sail area” added to by a mass of aircraft on the flight deck with wings folded upright; the “sail “took over & slewed the Melbourne almost broadside in the canal! There were some hectic moments in regaining control with the stern almost on one bank of the canal! The Captain later addressed the Ship’s Company & stated that one lesson learnt from that exercise was that an aircraft carrier with aircraft parked on the Flight Deck should never consider slowing down for an approaching convoy in the canal!
- The second incident occurred in the Red Sea when there was the alert of “fire below” – a dreaded call! The fire was quickly extinguished & we proceeded to Australia without further incident. .

**Setting up the Radar Workshop at RANAS Nowra – HMAS Albatross**

In early September, 1956 John Saywell was Drafted from HMAS Melbourne to RANAS, Nowra (HMAS Albatross) & was allocated I/C of the new Air Radar Workshop which was at that time a bare shell building. John Saywell set up this workshop to cope with the maintenance of the Venom Aircraft AI Mk 17 & the Fairey Gannet ASV Mk 19B Radars & provided instruction to technical personnel & to aircrew Observers so that they better understood the operation & capabilities of their equipment.

This completed the introduction of the AI Mk 17 Radar equipment into RAN service.